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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/566,036

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EXAMINER

CHANG, AUDREY Y

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/566,036	<b>Applicant(s)</b> COPPOLA ET AL.	
	<b>Examiner</b> Audrey Y. Chang	<b>Art Unit</b> 2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 17 October 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 15-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 15-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Remark***

- This Office Action is in response to applicant's amendment filed on October 17, 2008, which has been entered into the file.
- By this amendment, the applicant has canceled claims 1-14 and has newly added claims 15-26.
- Claims 15-26 remain pending in this application.

### ***Response to Amendment***

1. The amendment filed on October 17, 2008 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: the newly added claim 15 recites that the phrase "adding new arbitrary values to the digital hologram". The specification fails to give the explicitly support for adding arbitrary values to the digital hologram. .

Applicant is required to cancel the new matter in the reply to this Office Action.

### ***Specification***

2. The disclosure is objected to because of the following informalities:

The newly added claim 15, recites the phrase "adding new arbitrary values to the digital hologram obtaining an expanded array comprised of  $V_e = N_e M_e$  elements, where  $N_e = N_r + N'$  and  $M_e = M_r + M'$ , with  $N'$ ,  $M'$  being integer numbers each arbitrary values being equal to the same constant value", that is not explicitly expressed in the specification.

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

Art Unit: 2872

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. **Claims 15-26 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement.** The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The reasons for rejections based on the newly added matters are set forth in the section "response to amendment" above.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. **Claims 15-26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

The phrase "adding new **arbitrary** values to the digital hologram" recited in claim 15 is confusing since it is not clear what these "arbitrary values" are. Does this mean that ANYTHING can be added to the digital hologram? Also how such values are added?

It is not clear what is considered to be the "holographic image sampling intervals".

The phrase "processing the digitized hologram array" recited in claim 1 is confusing since it is not the "processing" is referred to what? Also what is this array?

It is not clear the discrete Fresnel transform is referred to what variables and to obtain what quantities? It is known that the discrete Fresnel transform is a mathematical function. A mathematical function generally takes certain variables to give certain result. This can be considered as transformation. However it is not clear what input variables are being **transformed** by this discrete Fresnel transform. It looks like the transformation is between image data to image data? This is not likely for ordinary Fresnel

Art Unit: 2872

transformation, which is normally between one coordinate to a different coordinate. The scopes of the claims are therefore really not clear since it is not clear the discrete Fresnel transform is transform between what and what?

The phrase "an array of  $V_e$  values" recited in claim 1 is confusing since it is not clear what is "Ve" and what are these  $V_e$  values?

The phrase "i.e." recited in claims 18 and 19 is confusing. This phrase renders the claim indefinite because it is unclear whether the limitation(s) following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

The phrase "the second step" recited in claim 20 is confusing since it is not clear what step is referred as the second step.

The scopes of claims 22-26 are confusing and indefinite since they each depend from a canceled claim.

### ***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. **Claims 15-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Cucho et al (PN. 6,262,818) in view of patent issued to Rackett (PN. 6,317,522).**

**Cucho** et al teaches a method for *numerical reconstruction of holographic image* wherein a *hologram* (4, Figure 1) is generated by interference of illuminated light on specimen (or an investigated object) in a set-up (2), with the holographic image being *detected* by an *image acquisition system* (5) such as charge couple device (CCD, please see column 11, lines 40-50) serves as the *image detection device*.

Art Unit: 2872

The detected holographic image is then *digitized* by an image digitizer (6) so that it is transformed into a digitized hologram (7).

Cuche et al teaches that the digitized hologram is an array  $I_H(k\Delta x, l\Delta y)$  of  $N_x$  by  $N_y$  digitally encoded numbers which results from the two dimensional spatial sampling of the hologram intensity  $I_H(x,y)$ , (please see column 11, line 66 to column 12, line 36). This means the digitized hologram is an array of elementary hologram pixels  $I_H(k\Delta x, l\Delta y)$ , with  $(\Delta x, \Delta y)$  being the sampling spacing or interval along the x-axis and y-axis (or  $O_x$  and  $O_y$  axes) in the **digitized hologram plane**. It is implicitly true that there are a number of elementary hologram pixels such as  $V_r$  of them. This also means that the image acquisition system must comprise an integrated array of the image detection elements, (please see columns 11-12).

Cuche et al further teaches that the method for reconstruction of the holographic image is obtained by *numerically reconstructed* the hologram (please see Figures 1 and 4-5). The numerical reconstruction of the hologram involves the step of *computing* digital reference wave  $R_D$ , performing multiplication of the digital hologram  $I_H$  and digital reference wave  $R_D$ , and obtaining digital transmitted wavefront  $\Psi_D(k\Delta x, l\Delta y)$  (Figure 4, could be identified as *processing the digitized hologram*) and then performing numerical calculation of the *scalar diffraction*. Or as in Figure 5, the numerical calculation of the scalar diffraction is directly performed on the digital hologram, (Figure 5). The *numerical scalar calculation* involves the *discrete Fresnel integral or transform*, (please see Equations 15-18, column 19 line 42 to column 20 line 33). The discrete Fresnel transform is to produce reconstructed wavefront  $\Psi(m\Delta\xi, n\Delta\eta)$  (please see Figures 4 and 5) in the *observation or image plane*. The symbols  $(\Delta\xi, \Delta\eta)$  are referring to the *sampling intervals in the observation or image plane* (please see column 17, line 53) and they are related to the sampling intervals  $(\Delta x, \Delta y)$  in the digitized hologram plane by the following relationships:

$$\Delta\xi=(\lambda d_R)/(N_x\Delta x) \text{ and } \Delta\eta=(\lambda d_R)/(N_y\Delta y),$$

Art Unit: 2872

with  $\lambda$  being the wavelength and  $d_R$  being the reconstruction distance and is equal to distance between the specimen or object and the detection device where the holographic image is detected (i.e. the hologram plane, please see Figure 2A and column 20, lines 38-55).

By these expressions the following expressions can be obtained,

$N_x = (\lambda d_R) / (\Delta \xi \Delta x)$  and  $N_y = (\lambda d_R) / (\Delta \eta \Delta y)$ , if  $\Delta \xi = \Delta x$  and  $\Delta \eta = \Delta y$ , then

$N_x = (\lambda d_R) / (\Delta x^2)$  and  $N_y = (\lambda d_R) / (\Delta y^2)$ .

This reference has met all the limitations of the claims. It however does not teach explicitly that the step of numerical reconstruction of the hologram involves the step of adding new *arbitrary* values to the digital hologram and therefore expands the array of elementary hologram pixels. But since the values added are arbitrary, this means any image processing for numerically filtering the array of the digital hologram will meet the limitation. It is known in the art to use image processing methods such as error correction coding to process the image data so that the image reproduced will be sharper. Rackett in the same field of endeavor teaches image processing schemes include linear extrapolation, and error correction coding etc, wherein image data matrix is expanded to include the correction coding to process the image. It would then have been obvious to one skilled in the art to apply the teachings of Rackett to apply standard image process scheme to sharpen the reconstructed image.

With regard to claims 16-21, the manners of coding the image data for image processing are considered to be matters of design choice to one skilled in the art for achieving the desired image quality. The optimization process is implicitly included.

With regard to claim 22, please see the equation analysis stated for claim 15 above.

With regard to claim 23, the same reconstruction process certainly can be applied to different wavelength of light for achieving color image.

With regard to claims 24-25, Cuche et al teaches the reconstruction method is being carried out in a computer system, (please see Figure 12A).

Art Unit: 2872

With regard to claim 26, Cuche et al teaches that processing unit is included to process the detected holographic image and to calculate reconstruction of the holographic image from digitized hologram.

***Response to Arguments***

9. Applicant's arguments with respect to newly added claims 15-26 have been considered but are moot in view of the new ground(s) of rejection.

10. Applicant's arguments are mainly drawn to newly added features in the claims that have been fully addressed in the reasons for rejection above.

***Conclusion***

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Audrey Y. Chang whose telephone number is 571-272-2309. The examiner can normally be reached on Monday-Friday (9:00-4:30), alternative Mondays off.



Art Unit: 2872

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephone B. Allen can be reached on 571-272-2434. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

***Audrey Y. Chang, Ph.D.***  
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